



Geo-Environmental Assessment

Unit A Finlan Road, Stakehill Industrial Estate,
Middleton, M24 2SJ

Presented to: **UBS Triton Property Fund**

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Delta-Simons Contact	Rachel Dixon (Rachel.Dixon@delatasimons.com)

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				Tom Bywater Consultant Stefan Brzeski Consultant	Rachel Dixon Senior	Sabine Sargeant Associate Pete Skinner Associate Director

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Executive Summary

Brief	Delta-Simons was instructed UBS Triton Property Fund to prepare a Geo-Environmental Assessment of Unit A, Finlan Road, Middleton, M24 2SJ for the demolition of existing single storey extension and service yard canopy, erection of extension and alterations to existing building, change of use to allow a flexible use within Classes B2, B8 and / or E(g)(iii) and a series of physical works to reconfigure the Site including an extension to the service yard, new hard and soft landscaping and associated infrastructure.
Site Setting	The Site currently comprises an 'L' shaped building which was formerly used for the manufacturing and distribution of car seats. Two service yards are located in the north and south of the Site, with commercial car parking located in the west and isolated areas of soft landscaping. The Site is located within a mixed commercial / light industrial area which forms the Stakehill Industrial Estate. Made Ground is recorded on the Site which is indicated to be underlain by superficial Devensian Till deposits (Secondary A Aquifer) and Pennine Lower Coal Measures Formation (Secondary A Aquifer). The site is not located within a development high risk areas with respect to coal mine workings. The Site is not located within a source protection area and no potable water abstractions are located within 1 km of the Site. The nearest surface water feature is the Whit Brook located approximately 15 m south of the Site at its closest point.
Ground Conditions	The current ground investigation recorded shallow Made Ground, underlain by Devensian Till superficial deposits comprising granular and cohesive strata, in the west of the Site. The central Site area comprised topsoil underlain by Devensian Till deposits of granular and cohesive strata. Pennine Coal Measures Formation bedrock is understood to underlie the Devensian Till but was not encountered during this ground investigation.
Land Contamination Assessment	Concentrations of contaminants within the soils were below their laboratory limits of detection and/or GAC for a commercial end use. Slightly elevated concentrations of chromium (VI), copper, and nickel have been reported in the groundwater, however, these are in the same order of magnitude as the GAC. The risk to controlled waters is considered to be low. Ground gas monitoring indicates the Site can be classified as CS1. Ground gas protection measures are not considered to be required within the proposed extension. Aggressive ground conditions were not encountered and buried concrete designs can be classified for DS-1 and ACEC-1. No vapour risk was identified during the ground investigation or chemical analysis.
Geotechnical Assessment	Traditional spread foundations are considered suitable for the proposed development based on pads up to 2.5m x 2.5m at depth of below 1m bgl founded on granular Devensian Till (and at least 0.3 m below the base of any Made Ground) based on an allowable bearing pressure of 200kPa which should limit post construction settlements to less than 25mm. Sloped ground along south-west border of Site may require slopes or earth retention to maintain or provide levels for the extension to the service yard. It is recommended that a conservative CBR value of 5% should be adopted for preliminary pavement design for external areas where shallow granular Made Ground and granular Devensian Till is encountered. Where cohesive Devensian

	Till is encountered a CBR value of <3% should be adopted for preliminary design purposes. Earthworks on Site will encounter predominantly Devensian Till deposits and reworked cohesive deposits. The natural and reworked cohesive Till will fall into Class 2A, 2B, and 2C, these soils are likely to achieve an adequate level of compaction dependant on end usage, though suitability for reuse on Site may require further assessment. The granular Till and Made Ground deposits are likely to fall into Class 1A well graded granular fill, these should be screened accordingly to separate granular and cohesive materials. The conditions of the shallow soils at the Site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater.
Data Gaps and Uncertainty	Design and placement of exploratory hole locations was limited due to on-Site buildings and overgrown areas in the south. Although some localised earthworks are anticipated to be required at the Site, a cut/fill drawing was not provided by the Client at the time of the intrusive ground investigation. The investigation was designed to provide preliminary information only and further information may be required in due course to discharge Site specific planning conditions and inform detailed design.
Recommendations	Based on the findings of this Report, the following recommendations are made; • Chemical and geotechnical analysis of the shallow Made Ground encountered in the west of Site if it is intended for reuse on site to assess its suitability; and, • Foundations Works Risk Assessment.
This is intended as a summary only. Further detail and the limitations of the assessment are provided within the main body of the Report.	

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1.0 Introduction

1.1 Appointment

Delta-Simons Limited ("Delta-Simons") was instructed by UBS Triton Property Fund (the "Client") to undertake multiple environmental assessments including the preparation of a Geo-Environmental Assessment at Unit A Finlan Road, Stakehill Industrial Estate, Middleton, M24 2SJ (the "Site").

1.2 Context & Purpose

The aim of the study was to complete a geo-environmental assessment of the proposed development area within the wider Site boundary. The investigation has obtained information regarding ground conditions, from which risks to end-users, the environment and structures have been assessed, with mitigation measures suggested where necessary. The investigation has also gathered geotechnical information to inform comment on the preliminary design of foundations and infrastructure. The Report provides recommendations for further work (where appropriate) based on the findings of the investigation.

1.3 Scope of Works

The scope of the investigation and layout of this Report has been designed with consideration of guidance on Land Contamination: Risk Management pages of the [GOV.UK](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf) web pages, the relevant requirements of the National Planning Policy Framework (NPPF) (as revised 2021) (paragraphs 174 & 183-184)¹ and the Planning Practice Guidance (Land Affected by Contamination)².

The project was undertaken to an agreed brief as set out in Delta-Simons' multi-disciplinary proposal, Appendix A - Phase 2 Intrusive Investigation (reference 22-1358), dated 29th June 2022.

The detailed scope of works is outlined in Section 3.

Specific sections of this Report may generally follow guidance set out in Eurocode 7 for a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007. Eurocode 7 includes specific guidance on the number and spacing of investigation positions, methods of investigation and sample quality to be achieved which may not have been met by this investigation. The Report also includes information which may support a Geotechnical Design Report (GDR) as defined in BS EN 1997-1:2004; however, unless otherwise explicitly stated, the investigation has not been undertaken in accordance with Eurocode 7 and the preliminary geotechnical interpretation, assessments, risk register (if included) and recommendations presented within this Report may not meet the full requirements of a GDR.

1.4 Proposed Development

The Site currently comprises a vacant industrial/warehouse unit with associated car parking and areas of soft landscaping. It is understood that a geo-environmental assessment is required to inform a planning application for the demolition of existing single storey extension and service yard canopy, erection of extension and alterations to existing building, change of use to allow a flexible use within Classes B2, B8 and / or E(g)(iii) and a series of physical works to reconfigure the site including an extension to the service yard, new hard and soft landscaping and associated infrastructure.

The preliminary proposed development plan (PDP) is provided as Drawing 1.

No planning conditions have yet been granted for the proposed redevelopment to the knowledge of Delta-Simons.

1

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf

2 <https://www.gov.uk/guidance/land-affected-by-contamination>

1.5 Existing Information

This Report must be considered in the context of the following reports undertaken by Delta-Simons:

- Preliminary Geo-Environmental Risk Assessment for Unit A, Finlan Road, Stakehill Industrial Estate, M24 2SJ (reference 90720.554768), dated January 2023;
- Preliminary Ecological Appraisal Technical Note for Unit A, Stakehill Industrial Estate (reference 90720.554772), dated January 2023; and,
- Tree Survey in accordance with BS5837:2012 for Unit A, Stakehill Industrial Estate (prepared for Delta-Simons by James Royston Arboriculture Consultant) (reference 90720.554772).

The following third-party reports also exist relating to the Site:

- *CON29M coal mining report, Proseat LLP, Stakehill Industrial Estate, Greater Manchester, M24 2SJ*, report by The Coal Authority, report number 51003332164001, dated January 2023.

1.6 Limitations

The assessment is limited to the issues agreed within the proposal for the works. General notes on limitations associated with this assessment are provided in Appendix A.

1.7 Data Gaps and Uncertainty

In addition, the following specific data gaps and uncertainty apply to this assessment:

- The presence of buildings on-Site dictated the location of the borehole locations;
- The southern part and eastern border of the Site were inaccessible at the site of the Site Investigation due to it being heavily overgrown;
- The investigation was designed to provide preliminary information only and further information may be required in due course to discharge Site specific planning conditions/ detailed design;
- The investigation was designed to inform ground conditions within the footprint of the proposed building extension and within the proposed service yard extension area only. A Site wide ground investigation was outside the scope of this investigation; and
- Although earthworks are anticipated to be required at the Site, a cut/fill drawing was not provided at the time of the intrusive ground investigation.

2.0 Site Details

2.1 Site Setting

A summary of the current Site status, environmental setting and key historical features is presented below. This has been summarised from the existing Report(s) listed in Section 1.5 which should be consulted for further detail.

Co-ordinates	Centred approximately at National Grid Reference 389230, 408020.	Elevation	Approximately 131 - 141 m AOD
		Area	Approximately 2.70 Ha (26,980 sq m)
Site Address and Location	Unit A, Finlan Road, Stakehill Industrial Estate, M24 2SJ. The Site is located to the north-east of Middleton and the north-west of Oldham, approximately 2km north of Mills Hills Train Station and approximately 500 m south of Junction 2 of the A627 (M) motorway. Google Map Links [Google Imagery ©2023, Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2023]		
Current Site Description	The central and eastern Site areas comprise a vacant warehouse unit with office and recreational space in the west of the building. The northern and southern areas are occupied by service yards and the western area of the Site is predominantly occupied by commercial car parking. Areas of soft landscaping are present along the Site boundaries with an isolated area in the centre of the Site. No activities are currently taking place on-Site.		
Physical Setting	Areas of Made Ground are recorded at the Site which is indicated to be directly underlain by superficial Devensian Till deposits (Secondary A Aquifer) and Pennine Lower Coal Measures Formation (Secondary A Aquifer). The Site is relatively flat with a slight downwards fall towards the south and south-west (Finlan Road). The Site is not located within a source protection area and no potable water abstractions are located within 1 km of the Site. The nearest surface water feature is Whit Brook located approximately 15 m south of the Site at its closest point.		
Key Historical Features	Based on a review of the compilation of historical sources dating back to 1851, the Site was vacant (likely agricultural land) until the 1990s when the current development was constructed. Aerial imagery dated 2000 confirms that the current Site layout had been achieved and no significant changes were noted following this period. Potentially historical contaminative land uses identified in the surrounding area include Stakehill (bleach) works, the potential infilling of a reservoir west of the Site, and various light industrial and commercial properties forming Stakehill Industrial Estate from the 1970s onwards.		
Summary of Preliminary Conceptual Site Model	The following potential contamination sources are considered: Contaminants from the former uses of the Site for seat manufacturing, which is understood to have included storage and use of organic chemicals. The Site was also potentially occupied by Woodbridge Foam (UK) Ltd, which likely also included storage and use of organic chemicals;		

	• Made Ground is recorded across the Site and surrounding area within geological mapping; however, this is likely to be limited given the Site's limited development history; • The former off-Site bleach works with associated tanks and filter beds; • Commercial/ industrial properties within the wider Stakehill Industrial Estate; and, • Infilling of a historical off-Site reservoir, approximately 50 m north-west of Site. The potential pathways are considered to be as follows: • Direct contact, ingestion or inhalation of soil bound contaminants / dust during or following redevelopment; • Inhalation of organic vapours associated with contamination; • Migration of ground gas / vapours into on-Site buildings causing asphyxiation or risk of explosion; • Leaching of contamination into groundwater followed by migration of groundwater to the wider groundwater environment or discharge to surface waters; and, • Direct contact between aggressive ground conditions and new infrastructure. Relevant potential receptors are considered to include: • Construction workers; • Third parties during construction (adjacent Site users and adjacent residents); • Future Site users and maintenance workers; • The Whit Brook watercourse; • The underlying superficial aquifers (Secondary A); and, • The Built Environment (new buildings and infrastructure / utilities). Widespread contamination was considered unlikely, and the preliminary risk assessment identified a low to moderate risk of soil/ groundwater contamination and hazardous ground gas at the Site.
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3.0 Ground Investigation

3.1 Intrusive Investigation

Delta-Simons carried out intrusive investigation work from 12th to 13th December 2022, and on 15th February 2023 to assess the potential linkages identified in the preliminary risk assessment and to provide preliminary geotechnical information.

3.2 Ground Investigation and Rationale

3.2.1 Intrusive Works

The ground investigation comprised the following items:

- Service avoidance exercise and topographic survey of exploratory holes to x,y,z co-ordinates;
- Supervision of all works by a Delta-Simons Geo-Environmental engineer. All intrusive locations were logged in general accordance with BS 5930:2015+A1:2020 Code of Practice for Ground Investigations;
- Drilling of one cable percussive borehole (CP101) to 10.00 m below ground level (bgl);
- Drilling of five dynamic sampler boreholes (DS101 to DS105) to a maximum depth of 5.45 m bgl;
- Progression of 12 Dynamic Cone Penetrometer (DCP) tests (DCP01 to DCP112) to a maximum depth of 0.86m bgl;
- Installation of three boreholes (CP101, DS101 and DS104) with a combined groundwater and ground gas monitoring standpipe; and,
- Excavation of three shallow trial pits for the purpose of BRE365 Soakaway Testing.

Intrusive exploratory hole location plans are presented as Figure 1.

Specific limitations affecting the proposed scope of works are summarised in Section 1.7.

Delta-Simons exploratory hole logs are presented as Appendix B together with the SPT Calibration Certificates, in accordance with BS EN ISO 22476-3:2005+A1:2011 (incorporating corrigendum No. 1 2007), Geotechnical investigation and testing - Field testing - Part 3: Standard Penetration Test for SPT trip hammers.

3.2.2 Rationale

Location	Rationale	Key Contaminants of Concern
CP101	Targeting the central area of proposed building extension and providing information of ground conditions at greater depth.	No specific contamination expected; potential for hydrocarbons including PAHs.
DS101 - DS105	Providing general coverage of proposed building extension area.	No specific contamination expected; potential for hydrocarbons including PAHs.
DCP101 - DCP112	To inform California Bearing Ratio (CBR) values in the areas the proposed extension of the existing service yard areas.	
SA101 - SA103	To assess the suitability of the underlying geology for a soakaway surface water drainage solution.	

3.3 Geotechnical Sampling and In-Situ Testing

3.3.1 Sampling

Sampling comprised disturbed jar/tab and bulk samples as detailed on the borehole logs. Undisturbed U100/ UT100 samples were collected where possible in cohesive soils as detailed on the cable percussion borehole log.

3.3.2 In-Situ Tests

Standard penetration tests were undertaken in all boreholes at 1.00 m intervals until 5.00 m bgl. The results of these tests are presented on the borehole logs included as Appendix B. A plot of Corrected SPT N values versus Depth is included as Figure 3.

The results of the DCP CBR tests, with interpretation in accordance with Design Manual for Roads and Bridges (DMRB) CS 299 Data for Pavement Assessment are included in Appendix C.

3.4 Geotechnical Laboratory Testing

A selection of soil samples were submitted to the UKAS accredited laboratory for a range of geotechnical testing, the results of which are included in Appendix D. The rationale for the laboratory tests undertaken is provided in the table below:

Laboratory Test	Test Standard	Number of Samples Tested	Rationale
Classification			
Water Content	BS1377-2:3 or BS EN ISO 17892-1	10	For general classification and to assess the potential for cohesive soils to shrink and swell due to changes in the water content of a soil associated with the presence, removal or addition of trees and shrubs.
Liquid and Plastic Limits	BS1377-2:4 - 5 or BS EN ISO 17892-12	8	
Particle Size Analysis (sedimentation)	BS1377-2:9.2 & 9.3 or BS EN ISO 17892-4	4	For general classification and to assess the suitability of the natural soils for re-use as an acceptable earthworks material in accordance with the Specification for Highways Works (SHW) (Series 600).
Soil Strength			
Quick Undrained Triaxial (single stage)	BS1377-7:8 or BS EN ISO 17892-8	1	To derive undrained shear strength (c_u) of cohesive soils. To assess the bearing capacity of the soil for foundation design purposes.
Geo-Chemical - Soil Samples			
pH	BRE Special Digest 1 or other	10	To assess the soil conditions of the Site in accordance with BRE Special Digest 1 Concrete in aggressive ground and specify an appropriate concrete class to resist chemical attack.
Water-Soluble Sulphate (2:1 water/soil extract)		10	
Acid Soluble Sulphate		6	
Total Sulphur		6	
Geo-Chemical - Water Samples			
pH	BRE Special Digest 1 or other	2	To assess the groundwater conditions of the Site in accordance with BRE Special Digest 1 Concrete in aggressive ground and specify an appropriate concrete class to resist chemical attack.
Soluble Sulphate			

3.5 Environmental Sampling and Laboratory Analysis

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite. Records of the samples taken as part of the Site investigation works, including their depths and location, are included within the exploratory hole records in Appendix B.

Two groundwater samples were collected from DS104 and CP101 on 25th January 2023. The groundwater samples were collected using a dedicated disposable bailer. Samples were stored in accordance with Delta-Simons' quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination. Samples analysed for environmental purposes were placed in chilled cool boxes on site and transported to the laboratory for analysis on completion of the Site investigation works/groundwater sampling visit.

The rationale for chemical analysis is presented in the table below and the results of the chemical laboratory testing are included in Appendix D and E.

Analytes	No. of Samples Tested		Rationale
	Soil	Ground-water	
Asbestos	4	-	Common potential contaminant - Analysed in all samples of Made Ground.
pH, As, Cd, Cu, Cr, Hg, Pb, Ni, Zn, speciated Polycyclic Aromatic Hydrocarbons (PAH)	4	2	Potential contaminants of concern, common to many sites.
Total Petroleum Hydrocarbons, Criteria Working Group Method (TPHCWG), Benzene, Toluene, Ethylbenzene and Xylene (BTEX)	4	2	
Volatile and Semi-Volatile Organic Compounds (VOC and SVOC)	3	2	Potential contaminants from the former use of the Site as a seat manufacturer.
pH, sulphate	10	2	To assess potential for chemical attack on buried concrete.

3.6 Monitoring Programme

Four rounds of groundwater level and ground gas monitoring were undertaken on all newly installed wells (CP101, DS101 and DS104) between 20th January and 15th February 2023.

Measurements of the depth to groundwater within the monitoring wells were taken using an electronic dip meter or interface probe.

To characterise the ground gas regime at the Site, an infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂) in percentage by volume. Initial and steady state concentrations were recorded. The atmospheric pressure before and during monitoring, together with the weather conditions, was recorded.

All monitoring results obtained to date are contained within Appendix G.

4.0 Ground Summary

4.1 Introduction

The sections below summarise the ground and groundwater conditions encountered during the Site investigation.

4.2 Ground Summary

A summary of the observed ground conditions at the Site is provided below:

Strata	Typical Strata Description	Depth Range of Strata Top (m)	Depth Range of Strata Base (m)	Thickness Range (m)	Comments
Topsoil	Grass over very soft dark greyish brown slightly sandy CLAY with frequent fine roots.	0.00	0.12 - 0.15	0.12 - 0.15	Present in CP101, DS101 - DS105
Made Ground	Tarmacadam.	0.00	0.08 - 0.09	0.08 - 0.09	Present in SA101 - SA103
Made Ground	Grey sandy gravelly COBBLES of sandstone, limestone, concrete, and brick. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of sandstone, concrete, limestone.	0.08 - 0.09	0.60 - 1.05	0.52 - 0.96	Present in SA101 - SA103
Devensian Till	Very soft greyish brown slightly sandy slightly gravelly CLAY with low cobble content of sandstone and limestone. or Loose to medium dense light brown slightly gravelly clayey fine to coarse SAND. or Firm to stiff brown slightly sandy CLAY with frequent 2 - 10 cm bands of orangish brown fine to medium sand.	0.12 - 7.20	0.42 - unproven	0.27 - unproven	Present in all locations

Ground conditions differ between the locations undertaken on the soft landscaped areas (CP101 and DS101 - DS105) and the locations undertaken within the car parking areas of hardstanding cover (SA101 - SA103).

At locations SA101 - SA103 across the car parking areas Made Ground was encountered to depths of 1.05 m bgl. The Made Ground in these locations followed the generalised sequence of tarmacadam

hardstanding over whitish grey sandy gravel over grey sandy gravelly cobbles. Between the Made Ground and natural Devensian Till at each of these locations a membrane of black plastic sheeting was encountered.

In SA101 a layer of clay was encountered between 0.54 – 0.57 m bgl. In SA103 a layer of concrete was encountered between 0.16 – 0.38 m bgl.

Locations CP101 and DS101 – DS105 were undertaken across soft landscaping within the centre of the Site. Natural superficial deposits comprising Devensian Till was encountered directly below the topsoil in all locations. The Devensian Till consists of sand and clay strata of varying depths, thicknesses, and densities.

In DS101 between 3.50 – 3.55 m bgl coal associated with Devensian Till superficial deposits was encountered as angular fine to medium gravel.

4.3 Groundwater

4.3.1 Strikes During Investigations

The groundwater strikes during the ground investigation are summarised below:

Exploratory Hole	Water strike during drilling (m bgl)	Water strike during drilling (m AOD)	Stratum	Comment
CP101	3.20	133.23	Devensian Till	Water level rose to 2.70 m bgl after 20 minutes and was noted to be a medium-fast seepage.
DS101	2.70	133.58	Devensian Till	Water level remained at 2.70 m bgl after 20 minutes.

4.3.2 Levels During Monitoring Programme

Groundwater levels were monitored on a total of four occasions between 20th January and 17th February 2023. Monitoring data and LNAPL measurements are provided in Appendix F and summarised in the table below.

Exploratory Hole	Water level during monitoring Max to Min Range		LNAPL Y/N	Stratum
	m bgl	m AOD.		
CP101	3.65 – 3.75	132.78 – 132.68	N	Devensian Till
DS101	Dry	Dry	N	
DS104	3.11 – 3.38	132.87 – 132.60	N	

Groundwater levels during monitoring varied between 3.11 and 3.75 m bgl (132.68 – 132.87 m AOD) within the Devensian Till. Groundwater is expected to flow to the south and south-west, following the gentle slope of the Site topography towards Whit brook.

4.4 Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of potential gross contamination was observed during the investigation.

4.5 Material Properties

The table below summarises the factual material properties based upon the results of in-situ and laboratory test data and where appropriate provides derived geotechnical parameters.

Parameter	Unit	Value or Range (adopted characteristic design parameters)	Justification
Devensian Till			
w (Water Content)	%	2.7 - 23	Laboratory Testing
IP (Plasticity Index)	%	8 - 14	Laboratory Testing
PL (Plastic Limit)	%	10 - 14	Laboratory Testing
LL (Liquid Limit)	%	19 - 28	Laboratory Testing
I'P (Modified Plasticity Index)	%	6 - 14	Modified PI derived from I'P = (IP x % Passing 425 µm) / 100.
Volume Change Potential	-	Low	NHBC
Uncorrected SPT 'N'	Blows	2 - 19	In Situ Testing
γ (Bulk Density)	Mg/m ³	2.24	Laboratory Testing
γ _d (Dry Density)	Mg/m ³	1.97	Laboratory Testing
Cu (Undrained Shear Strength)	kPa	70	Laboratory Testing

4.6 Geochemical Testing

Geochemical analysis was undertaken on six soil samples of Devensian Till, tested for selective contaminants (BRE Special Digest 1:2005 (3rd Edition), Concrete in Aggressive Ground, the results of which are summarised in the table below:

Tests	No. of Tests	Minimum	Maximum
Devensian Till			
Soil - pH	10	7.4	8.6
Soil - Total Sulphur	6	<0.006%	0.068%
Soil - Acid Soluble Sulphate	6	2.9 mg/kg	47 mg/kg
Soil - Water Soluble Sulphate	10	1.4 mg/L	23.7 mg/L
Soil - Total Sulphate	6	<0.006%	0.022%
Water - pH	2	7.1	8.0
Water - Sulphate	2	111 mg/L	216 mg/L

5.0 Introduction

5.1 Summary of Development Proposals

The proposed development comprises the construction of an extension to the currently existing warehouse, and the extension of the existing service yard. A proposed development plan is provided as Drawing 1.

At the time of writing, structural and floor loadings and final levels were unknown. Consequently, the information provided below should be treated as preliminary and will be subject to review once a scheme and levels have been finalised, and therefore further detailed assessment may be required.

5.1.1 Preliminary Geotechnical Hazards

The geohazards listed below have been identified to follow guidance presented in the HE document CD622 'Managing Geotechnical Risk' (2020) which aims to identify and manage the geotechnical risks associated with a scheme throughout its lifespan, from planning to construction to maintenance.

The following geohazards are considered to be substantial ground related risks associated with the proposed development. A substantial risk is defined by Delta-Simons in Appendix H.

- **Shallow Made Ground:** the western part of the Site is underlain by shallow Made Ground to depths of up to 1.05 m bgl. It is expected the Made Ground was placed in this area to provide a base for the construction of the car parking area. Made Ground is typically variable in nature and strength with a potential low bearing capacity and unacceptable levels of total/differential settlement may occur;
- **Slopes:** Along the south-west border of the Site the ground slopes to the south-west. It is anticipated that some slopes or earth retention may be required should the extension to the service yard be kept at the same level as the existing service yard area;

Whilst the PRA report identified that the Site lies within a Coal Mining Reporting Area, although not within a Development High Risk Area. The CON29M Coal Mining Report from the Coal Authority (reference 305482979_2) stated that the Site area is not affected by past or present coal mining; future planned coal mining; mine entries existing on-Site; previous opencast mining; mine gas emissions. It is therefore considered that the risk from future coal mining related subsidence is very low and this is not considered a substantial ground risk.

5.2 Foundations

The assessment below, in reference to Eurocode 7, has assessed both the Ultimate Limit State (ULS) bearing capacity and Serviceable Limit State (SLS) for subsequent consideration for the preliminary and outline design of foundations. As the building loads are not yet available, the following situation has been assumed with the associated partial factors applied to the soil parameters only:

- Design Approach 1 (DA1) Combination 2 (A2 + M2).

Parameter / Action	Partial Factors	
	A2	M2
Undrained Shear Strength	-	1.40
Unit Weight of Soil	-	1.00
Live Load (variable unfavourable)	1.30	-
Weight of Foundation (permanent unfavourable action)	1.00	-

Verification of the serviceability limit state will be undertaken as a check calculation of acceptable settlement. When the final structural loads are known and finalised, it would be prudent to re-assess this assessment in accordance with Design Approach 1, Combination 1 where partial factors are applied to the building loads for comparison with the most onerous scenario adopted for design.

5.2.1 Spread Foundations

The ground model is characterised by topsoil across the central Site area, underlain by superficial deposits comprising medium strength Devensian Till of mixed granular and cohesive composition. Granular (sand) deposits are predominantly encountered below the area of the proposed extension and the geotechnical assessment has assumed this.

Shallow Made Ground is encountered in the west of the Site extending to depths of 1.05 m bgl. Made Ground encountered comprised engineered granular fill, larger cobbles, and buried concrete in one location to depths of 0.38 m bgl. Natural soils underlying the Made Ground comprised loose to medium dense sand, underlain by soft to firm clay.

The advice and recommendations provided below are based upon the current ground model. The assessment may require revision in the event substantive earthworks/enabling works are undertaken.

Topsoil has been recorded in all intrusive locations within the proposed warehouse extension building footprint. Topsoil is not considered to be suitable as a stratum for founding upon given the organic content of soil, heterogenous composition and typically poor strength properties.

Should natural undisturbed shallow granular Devensian Till formation be encountered within economic reach for traditional spread foundations (pads up to 2.5 m x 2.5 m) placed below 1m and at least 0.3m below the base of any Made Ground, then for preliminary foundation design purposes the medium dense (SPT N value of ~15) granular soils are likely to achieve an allowable bearing capacity of 200 kPa (with settlement limited to 25 mm).

CP101 recorded an area of soft clays beneath the medium dense sand at approximately 5.00 m bgl. This is considered to be deep enough to be outside the effective zone of foundation influence for pads up to 2.5m x 2.5m placed at a maximum depth of 1m bgl, and not considered to adversely affect settlement.

It is assumed that if soft clays are encountered at shallow depth, the unsuitable soils should be removed and the excavation deepened until a more competent stratum is identified. The formation layer should then be heavily proof rolled, any soft spots excavated and replaced with well compacted granular material.

Given that both cohesive and granular soils have been identified at formation level consideration should be given to ensure that foundations across the building footprint are cast in uniform strata in order limit the potential for differential settlement. Where necessary suitable reinforcement should be allowed for to accommodate any differential settlement.

All foundation excavations should be inspected by a suitably qualified engineer prior to casting to ensure the appropriate depth, founding medium and strength characteristics have been achieved. Where both granular and cohesive soils are identified at formation level in the same excavation or across short lateral distances in adjacent excavations, it would be prudent to verify the allowable bearing pressure by means of a Plate Bearing Test.

5.2.2 Volume Change Potential

The volume change potential should be considered in any foundation schedule for structures and services located within the influence zone of trees or bushes (proposed, existing or to be removed) and appropriate precautions and/or founding depths should be designed accordingly. In cohesive soils, it is recommended that foundations should be designed in accordance with NHBC Standard Chapter 4.2 *"Building Near Trees"*.

Based on the modified plasticity index, the cohesive Devensian Till formation is considered to have a low volume change potential.

5.2.3 Ground Improvement Techniques

Given the design loads are expected to be generally light, it is not anticipated that ground improvement techniques will be necessary to improve soils for the purpose of supporting proposed foundation loads.

5.3 Earthworks

At the time of writing, finished levels were unclear although, it is understood that to some degree earthworks will be required as part of the proposed development although a significant cut and fill operation is not anticipated.

The table below summarises material grading results and the corresponding earthworks class, in accordance with the 'Specification for Highways Works, Series 600', Table 6/2.

Exploratory Location	Depth (m bgl)	Strata	Cobble Content (%)	Gravel Content (%)	Sand Content (%)	Fines <0.063 mm (%)	Series 600 Earthworks Class (Table 6/2)
CP101	0.70 - 2.00	Devensian Till	0	14	49	37	2C
CP101	2.00 - 2.45	Devensian Till	0	5	83	12	1A
CP101	4.00 - 4.45	Devensian Till	0	6	88	6	1A
CP101	6.00 - 6.45	Devensian Till	0	3	71	26	2A & 2B

Shallow earthworks on the Site will likely predominantly encounter Devensian Till deposits and reworked cohesive deposits. The natural and reworked cohesive Till will both likely fall into Class 2A, 2B or Class 2C. The granular Till and Made Ground deposits are likely fall into Class 1A well graded granular fill. Where mixed cohesive and granular Till deposits are encountered and intended for reuse within earthworks, they should be screened accordingly to separate granular and cohesive materials.

The majority of natural soils, as dug, are likely to achieve an adequate level of compaction without any moisture content modification. The shallow Made Ground in the west may require further laboratory analysis before its suitability for earthworks can be established.

Materials used as fill will need to be placed to a suitable engineering specification with the degree of compaction required will be dependent on end usage and serviceability criteria. For example, a lesser degree of compaction may be suitable for paved areas than for building platforms supporting foundations and ground bearing slabs.

The suitability of earthworks materials has been assessed on the basis of the testing carried out as part of this investigation. The materials encountered on-site may vary from those analysed; furthermore, inclement weather or winter working may result in materials being unsuitable for incorporation within the works without modification by lime, cement or other methods. In particular, cohesive soils are very susceptible to 'wet weathering working'. Further assessment of their moisture content and any subsequent modification needed should be carried out if these materials are to be used in earthworks during inclement weather or the winter period.

Unprotected stockpiled materials often deteriorate due to water infiltration and they may become unsuitable for incorporation in the works.

Further earthworks testing will be required prior to completion of a suitably detailed earthworks specification for the works.

5.4 Roads and Pavements

It is recommended that a conservative CBR value of 5% should be adopted for preliminary pavement design for external areas for the shallow granular Made Ground in the west and south Site areas or for granular Devensian Till. Where cohesive Devensian Till is identified a CBR value of <3% should be adopted for preliminary design purposes. It is recommended that plate bearing CBR tests are undertaken at formation level after demolition of current car parking in this area prior to finalising pavement design.

5.5 Excavations & Obstructions

It is expected that conventional mechanical excavators will readily remove the natural material likely to be encountered in shallow excavations across the central Site area where the warehouse extension is planned.

Across the south and west Site areas, where the existing car parking is to be replaced by the service yard extension, conventional mechanical excavators will readily move the shallow Made Ground and underlying natural material likely to be encountered, although a breaker is likely to be required to remove any existing concrete hardstanding.

It should be noted that a network of utilities services run across the Site, in particular drainage pipes running underneath the car parking areas in the west and south of Site. These will require the review of service utilities plans and CCTV drainage reports prior to any excavations taking place.

All shallow foundation or services excavations at the Site should be considered unstable, therefore, temporary support of all excavations should be considered when excavating on-Site. All excavation works should be undertaken in accordance with CIRIA Guidance Document R97 "Trenching Practice".

5.6 Drainage and Soakage Tests

Soil infiltration tests were carried out in two soakage test pits in general accordance with BRE 365. The soakage test pits were targeted down topography in the south and west of the Site within the cohesive deposits at depths between 1.60 and 2.00 m bgl. All pits were prepared with a gravel pack and monitoring standpipe. A summary of the test results is presented in the table below, and the full results are presented in Appendix H.

Soakage Test Location	Response Strata	Soil Infiltration Rate (m/s)
SA101	Devensian Till	Failed test.
SA103	Devensian Till	Failed test.

Due to the impermeable nature of the underlying cohesive deposits, SA101 and SA103 monitoring pits failed to produce a valid infiltration rate. It should be noted that in other areas of the site where granular Till deposits were encountered, infiltration rates may be higher as they generally have an inherent higher permeability.

5.7 Groundwater

Significant groundwater would not be anticipated during the shallow excavations required as part of the proposed development. Should any perched groundwater be encountered, then local dewatering via sump and pump should be suitable, however, treatment prior to disposal to sewer may be required. Should significant earthworks be required greater than approximately 3m bgl then groundwater may be encountered, in which case groundwater control or exclusion measures may be required.

5.8 Chemical Attack on Buried Concrete

In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the shallow soils at the Site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater, when considering the most appropriate type of concrete to be used at the Site for shallow foundations in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

6.0 Generic Quantitative Risk Assessment

6.1 Introduction

The presence of hazardous substances in or on a Site is generally only of concern if an actual or potential unacceptable risk exists. Legislation and guidance on the assessment of contaminated sites, consistent with UK best practice, acknowledges the need for a tiered risk-based approach. This section represents a Generic Quantitative Risk Assessment (GQRA) being a comparison of Site contaminant levels against Generic Assessment Criteria.

6.2 Human Health GQRA

The assessment of risks in relation to human health has been undertaken using Generic Assessment Criteria (GAC) as detailed within the appropriate tables. Risks from soil, groundwater and Non-Aqueous Phase Liquids (NAPL) have been considered. The GAC are predominantly based on long term (chronic) risk to health. However, in the limited circumstances where short-term (acute) risks are more pronounced, these GAC have been utilised to ensure a thorough and conservative initial assessment is undertaken.

Based on the proposed industrial use, the soil and groundwater chemical data has been compared against a commercial end use GAC for 1% soil organic matter (SOM) content.

6.2.1 Risks from Soil Sources

None of the contaminant concentrations reported in soil exceeded the relevant Generic Assessment Criteria (GAC). Therefore, the soil contaminant concentrations are not considered likely to represent a risk to human health.

Asbestos was not detected in any of the samples which were screened for asbestos.

6.2.2 Risks from Groundwater Sources

Based on the proposed use of the Site for industrial use, the groundwater chemical data has been compared against a commercial end use GAC to assess risks from groundwater sources to indoor air and subsequent vapour inhalation indoors.

None of the Site-specific contaminants of concern were recorded at concentrations in excess of their laboratory detection limits / respective GAC.

6.2.3 Risks from Non-Aqueous Phase Liquids (NAPL)

Soil and groundwater exposure models used in generating Generic Assessment Criteria do not account for the potential for NAPL to represent a source of risk to human health, principally due to the production of vapours. Whilst it is possible to calculate theoretical soil saturation limits, in reality, due to co-solubility effects, these are not an appropriate indicator of the presence of NAPL. In order to assess the presence of NAPL, for petroleum hydrocarbons, an assessment criterion of 5,000 mg/kg for Total Petroleum Hydrocarbons has been applied based on professional experience.

The following has been identified in relation to NAPL at the Site:

- No observations of NAPL were made within the soils observed during drilling;
- No concentrations of Total Petroleum Hydrocarbons in excess of 5,000 mg/kg were recorded;
- No NAPL was measured during groundwater monitoring works.

On this basis, there is no evidence of NAPL being present on the Site.

6.3 Controlled Waters/Water Environment GQRA

The approach adopted to assessing risks to Controlled Waters/Water Environment is based principally on considering the concentrations of contaminants identified within the groundwater samples obtained in comparison to relevant GAC.

Given the 'prevent and limit' approach of the Water Framework Directive (2000/60/EC) and the identified receptors, a range of Water Quality Standards (WQS) have been applied as Generic Assessment Criteria (GAC), these include Water Framework Directive standards and thresholds (WFD), the Freshwater Environmental Quality Standards (EQS), the UK Drinking Water Quality Standards (DWQS), WHO Guidelines for Drinking Water Quality or SEPA resource protection values which have been used as initial conservative GAC to assess whether groundwater contamination requires further assessment or discussion in terms of the risks to controlled waters. Where specific water quality standards are not available, Delta-Simons has adopted surrogate values based on professional judgement (DS GAC).

6.3.1 Groundwater Results

The identified controlled water receptors are Whit Brook watercourse located 15 m to the south of Site which feeds the Rochdale Canal located approximately 655 m west of Site, and the underlying superficial and bedrock Secondary A aquifers. Considering the above and given the light industrial use of the Site and the surrounding area, the Site is considered to be of a low to moderate sensitivity. The results of the groundwater analysis have been compared to the GAC for the protection of surface waters.

Laboratory results above the relevant GACs are summarised in the table below.

Contaminant	Max Conc. (µg/l)	GAC (µg/l)	GAC Source	No. Exceed GAC / No. of samples	Location of Exceedances = Concentration (µg/l)
Metals					
Chromium (VI)	9.3	3.4	WFD 2015b	2/2	CP101 - 9.1; DS104 - 9.3
Copper	2.1	1.0	WFD 2015b	2/2	CP101 - 2.1; DS104 - 2.0
Nickel	4.4	4.0	WFD 2015a	1/2	DS104 - 4.4
Notes: WFD 2015a = Water Framework Directive (Standards and Classifications) Directions (England and Wales) 2015 - EQS for Priority Substances and Other Pollutants used to clarify chemical status. WFD 2015b = Water Framework Directive (Standards and Classifications) Directions (England and Wales) 2015 - Standards for Specific Pollutants.					

6.3.2 Groundwater Results Summary

Slight exceedances of the GAC for the protection of surface waters have been recorded for chromium (VI), copper and nickel. The exceedances, however, are within the same order of magnitude as the GAC. Furthermore, the GAC for copper and nickel is considered conservative, as it assumes that all copper and nickel is bioavailable, and this is unlikely to be the case, therefore it is considered that there is a low risk to surface waters.

Additionally, the Site is considered to be of a low to moderate sensitivity given the light industrial use of the Site and the surrounding area. The Site is not located within a Source Protection Zone (SPZ) and there are no SPZs, potable water abstractions, or surface water abstractions are present within 1 km of the Site. Whilst the underlying aquifers beneath the Site have the potential to be a future resource for human consumption, it is unlikely that a potable water abstraction would be implemented in the near future given the industrial use of the Site and the surrounding area.

6.4 Built Environment

6.4.1 Potable Water Supply Pipes

The investigation requirements for the selection of potable water pipe material are set out in UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (UKWIR,

2010). This Report has very specific and onerous investigation requirements and as such the detailed investigation of each utility route was not within the scope of this investigation. The relevant water supply company needs be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

However, given the absence of organic contamination found at the Site, it is not expected that barrier pipe material would be required when considering potable water pipes.

6.4.2 Building Materials

Risks to building materials associated with aggressive ground conditions is addressed in Section 5.8. The conditions of the shallow soils at the Site are classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater.

6.5 Waste Management

In recent years a number of mechanisms have aimed to change the way in which waste materials have traditionally been managed (*i.e.* a move away from less sustainable options such as landfill disposal). These include:

- Legislation and guidance (e.g. the Waste Framework Directive [2008, as amended]; the Waste [England and Wales] Regulations, 2011; the Definition of Waste: Development Industry Code of Practice, Version 2 [DoWCoP; CL:AIRE, 2011]);
- Fiscal drivers (e.g. the landfill tax escalator);
- Corporate responsibility campaigns (e.g. WRAP: Halving waste to landfill & Quality Protocol projects; Ellen Macarthur Foundation).

There is now a greater focus on waste re-use, treatment and recovery as organisations try and move their waste materials up the Waste Hierarchy and move to more circular models of material supply and re-use.

In accordance with current industry best practice, guidance and legislation Delta-Simons would always recommend options including managing materials on site through the DoWCoP, waste treatment and waste recovery be considered ahead of landfill disposal. Landfill disposal should be seen as an option of last resort given that in terms of cost, environment and social outcomes it is less sustainable. However, the availability of alternatives to landfill disposal depends on the timescales of the project, proactive involvement of qualified advisors and the nature and status of the materials being considered.

6.6 Waste Classification

In general, the predominant waste material encountered during the construction phase of development schemes will likely be construction and demolition waste, predominantly waste soils and crushed demolition arisings. These may be found *in situ* in the ground or stockpiled on sites and they may be contaminated which may have implications for their classification and subsequent management.

This investigation was not undertaken to advise on the classification or potential management routes for such waste materials. Classification and management of these types of wastes either on to site, off site or within the development are likely to require further investigation and assessment. The extent of such work will depend on the particular management option that is being considered and could, for example, involve the use of waste acceptance criteria analyses.

7.0 Bulk Ground Gas Risk Assessment

7.1 Ground Gas Conceptual Site Model

7.1.1 Sources

Made Ground has been identified as a potential source of ground gas on-Site, however it was generally noted to be absent of putrescible material.

The off-Site infilled reservoir has been discounted due to its distance from Site.

7.1.2 Pathways

- Vertical and lateral migration of ground gas through semipermeable strata;
- Potential for gases to enter current and future buildings through voids in the floor including service entry points and cracks and accumulate in confined spaces;
- Future maintenance/construction workers may come into contact with hazardous ground gases via entry into below ground confined spaces such as excavations or service entries/inspection points.

7.1.3 Receptors

The principal receptors under consideration are future Site users.

7.2 Duration & Extent of Monitoring

Tables 5.5a and 5.5b within CIRIA C665 detail current recommended monitoring duration and frequency for sites in the UK. Based on the identification of potential sources, the gas generation potential is considered to be very low, whilst the sensitivity of the proposed development is low. On this basis, CIRIA C665 recommends four visits over a one-month period.

Gas monitoring has been carried out at the Site on four occasions for the assessment of the ground gas regime.

The locations of the monitoring wells are highlighted on Figure 2 and indicate representative coverage across the footprint of the proposed building extension.

Barometric pressures during the gas monitoring period ranged from 1013 mBar to 1038 mBar, of which one visit was completed during a period of falling pressure.

7.3 Ground Gas Risk Assessment

7.3.1 Background

Based on the proposed commercial end use, the following documents have been consulted when assessing the gas regime at the Site:

- CIRIA C665 (2007), Assessing risks posed by hazardous ground gases to buildings;
- British Standards Institute (BSI, 2019): Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, BS:8485:2015+A1:2019.

The presence of a source of hazardous gas within the ground does not necessarily indicate a risk will be present. Consideration of recorded gas flows together with source concentrations can allow an initial assessment to be made of the potential both for generation and subsequent migration of gas. A Characteristic Situation (CS) is derived from an assessment of the ground gas data and forms the basis of determining mitigation measures.

7.3.2 Gas Screening Value (GSV)

The Gas Screening Value (gas concentration as a fraction x maximum recorded flow) (GSV) is used to provide an initial assessment of risks to future Site users. The GSVs calculated for the monitoring wells are presented in the following table.

Location	Maximum Steady Methane (%v/v)	Maximum Steady Carbon Dioxide (%v/v)	Maximum Steady Flow Rate (l/hr)	GSV/Classification				Flooded?
				Methane		Carbon Dioxide		
				GSV	Classification	GSV	Classification	
CP101	<0.1	3.6	<0.1	0.0001	CS1	0.0036	CS1	N (0/4)
DS101	<0.1	0.7	4.0	0.004	CS1	0.028	CS1	N (0/4)
DS104	<0.1	6.7	0.1	0.0001	CS1	0.0067	CS1	N (0/4)

The ground gas monitoring data indicates that the Site can be classified as CS1 (very low hazard potential) in accordance with BS 8485:2015 Table 2 for commercial buildings. A marginally elevated concentration of carbon dioxide has been recorded at one borehole location, however, when considering the conceptual site model, and there not being a significant source, it is thought that this marginal elevation could be related to microbial activity.

7.4 Ground Gas Risk Mitigation

Based on the ground gas monitoring undertaken at the Site, ground gas protection measures are not considered to be required within the proposed extension.

7.5 Radon

The Site is located within an area where radon protective measures are not required.

7.6 Organic Vapours

No sources of volatile vapours have been identified as part of the ground investigation.

8.0 Revised Conceptual Site Model

A revised CSM is presented in the table below, and has been formulated taking into account all of the available data from the Delta-Simons intrusive investigation, suitable for a site with a proposed commercial end use.

Revised Conceptual Site Model				
Source	Pathways	Receptors	Pollutant Linkage?	Discussion and Mitigation
Potentially contaminated soils beneath the Site in relation to past industrial uses	Direct contact, ingestion, and / or inhalation of dust and vapours	Human health - future Site users	No	Contaminant concentrations were not found to exceed their respective commercial end use GAC and/or laboratory limit of detection. Furthermore, it is understood that the majority of the development area is to be covered by the proposed building extension. As such, it is considered reasonable to discount the soils within the proposed building extension footprint from presenting a significant risk of harm to the health of future Site users.
	Direct contact, ingestion, and / or inhalation of dust and vapours	Human health - construction workers	No	Contaminant concentrations were not found to exceed their respective commercial end use GAC and/or laboratory limit of detection. Furthermore, it is understood that the majority of the development area is to be covered by the proposed building extension. As such, it is considered reasonable to discount the soils within the proposed building extension footprint from presenting a significant risk of harm to the health of future construction workers. In addition, the provision of appropriate personal protective equipment (PPE) or respiratory protective equipment (RPE) would further eliminate the risk.
	Migration of contaminants into groundwater and / or migration of contaminants off-Site	Whit Brook and Secondary (A) Aquifers	No	Although a surface water receptor is within close proximity of the Site (Whit Brook, 15 m south), and Site is underlain by Secondary (A) Aquifers; contaminant concentrations were not found to exceed their respective commercial end use GAC and/or laboratory limit of detection. Negligible concentrations of all potential contaminants were recorded in the soil, and the low permeability of ground conditions reduces the risk of significant contaminant migration off-Site.
Ground gas	Vertical and lateral migration of ground gasses	Indoor exposure/explosive hazard via enclosed space accumulation of ground gas	No	The ground gas monitoring data indicates that the Site can be classified as CS1 (very low hazard potential) in accordance with BS 8485:2015 Table 2 for commercial buildings. A marginally elevated concentration of carbon dioxide has been recorded at one borehole location, however, when considering the conceptual site model, and there not being a significant source of ground gas, it is thought that this marginal elevation

Revised Conceptual Site Model				
Source	Pathways	Receptors	Pollutant Linkage?	Discussion and Mitigation
				could be related to microbial activity. Ground gas protection measures are not considered to be required within the proposed extension.
Elevated metals in groundwater	Migration of contaminants into surface water	Whit Brook (15 m south)	No	Slight exceedances of the GAC for the protection of surface waters for chromium (VI), copper and nickel have been detected in the groundwater, however, the exceedances are within the same order of magnitude as the GAC. Additionally, the GAC for copper and nickel is considered conservative, as it assumes that all copper and nickel is bioavailable, and this is unlikely to be the case, therefore it is considered that there is a low risk to surface waters and no further action is considered necessary.

9.0 Conclusions & Recommendations

9.1 Ground Model Summary

Ground conditions underlying the Site were found to comprise Made Ground (including concrete) in the west of the Site and Topsoil in the central site area overlying Devensian Till of sand and clay. The Pennine Lower Coal Measures bedrock was not encountered in any of the exploratory locations.

Groundwater was recorded in two locations in the central Site area during the Ground Investigation. Water levels recorded during monitoring rounds and chemical analysis of water samples collected from each location indicate a continuous body of groundwater within the superficial Devensian Till deposits at a depth of between 3.11 – 3.75 m bgl.

9.2 Geotechnical Summary

9.2.1 Geotechnical Hazards

Topography along the south-west border of Site falls to the south and south-west which may require slopes or earth retention if the levels of the service yard extension are to be kept at the same level as the existing service yard.

9.2.2 Foundations

Traditional spread foundations are considered suitable for the proposed development. Pads up to 2.5 m x 2.5 m placed below 1 m and at least 0.3 m below the base of any Made Ground, to be placed within medium dense granular soils to achieve an allowable bearing capacity of 200 kPa (with settlement limited to 25 mm).

The cohesive Devensian Till formation is considered to have low volume change potential.

It is not expected that ground improvement techniques will be necessary for supporting proposed foundation loads.

9.2.3 Earthworks

Earthworks on Site will encounter predominantly Devensian Till deposits and reworked cohesive deposits. The natural and reworked cohesive Till will fall into Class 2A, 2B, and 2C, these soils are likely to achieve an adequate level of compaction dependant on end usage, though suitability for reuse on Site may require further assessment. The granular Till and Made Ground deposits are likely to fall into Class 1A well graded granular fill, these should be screened accordingly to separate granular and cohesive materials.

9.2.4 Roads and Pavements

It is recommended that a conservative CBR value of 5% should be adopted for preliminary pavement design for external areas where shallow granular Made Ground and granular Devensian Till is encountered. Where cohesive Devensian Till is encountered a CBR value of <3% should be adopted for preliminary design purposes.

9.2.5 Groundwater

Significant groundwater is not anticipated during shallow excavations required as part of the proposed development.

9.2.6 Drainage and Soaks

Two soakage test pits were undertaken with both tests failing to soak away, alternative drainage methods should be considered for Site.

9.2.7 Chemical Attack on Buried Concrete

The conditions of the shallow soils at the Site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater.

9.3 Contamination Summary

The investigation has been carried out in order to provide information on the quality of the soil and groundwater beneath the footprint of the proposed building extension on-Site in the context of land contamination, and to provide information on the ground gas regime underneath that area of Site for a commercial end use. The assessment is being completed prior to the building of the proposed building extension.

Data gaps and uncertainties remain as outlined within Section 1.7.

9.3.1 Human Health

Contaminant concentrations were not found to exceed their respective commercial end use GAC and/or laboratory limit of detection. Furthermore, it is understood that the majority of the development area is to be covered by the proposed building extension. As such, it is considered reasonable to discount the soils within the proposed building extension footprint from presenting a significant risk of harm to the health of future Site users.

Although no asbestos containing materials (ACM) were identified in the samples analysed, ACM may be present within the buildings currently on-site.

9.3.2 Controlled Waters

Slightly elevated chromium (VI), copper, and nickel concentrations have been recorded in the groundwater when compared to the GAC for the protection of surface waters, however, the exceedances are within the same order of magnitude as the GAC. Additionally, the GAC for copper and nickel is considered conservative, as it assumes that all copper and nickel is bioavailable, and this is unlikely to be the case, therefore it is considered that there is a low risk to surface waters.

Furthermore, the Site is considered to be of a low to moderate sensitivity given the light industrial use of the Site and the surrounding area. Additionally, the Site is not located within a Source Protection Zone (SPZ) and there are no SPZs, potable water abstractions, or surface water abstractions are present within 1 km of the Site. Whilst the underlying aquifers beneath the Site have the potential to be a future resource for human consumption, it is unlikely that a potable water abstraction would be implemented in the near future given the industrial use of the Site and the surrounding area.

9.3.3 Ground Gas

The ground gas monitoring data indicates that the Site can be classified as CS1 (very low hazard potential). A marginally elevated concentration of carbon dioxide has been recorded at one borehole location, however, when considering the conceptual site model, and there not being a significant source of ground gas, it is thought that this marginal elevation could relate to microbial activity. It is considered that ground gas protection measures would not be required within the proposed extension.

9.3.4 Volatile Vapours

No potential sources of volatile contaminants have been identified.

9.3.5 Built Environment

The ground investigation was not designed to assess ground conditions in full accordance with the UKWIR guidance for water supply pipes. However, based on the general absence of petroleum hydrocarbons including hydrocarbons in the ground, the use of standard plastic infrastructure is likely to be suitable in the event that new water supply pipes are required.

Aggressive ground conditions associated with elevated sulphates have not been recorded on-Site. As such buried concrete is to be designed to class DS-1 and ACEC-1 within the Devensian Till natural strata.

9.4 Recommendations

Based on the findings of this Report, the following recommendations for supplementary investigation / assessment are made:

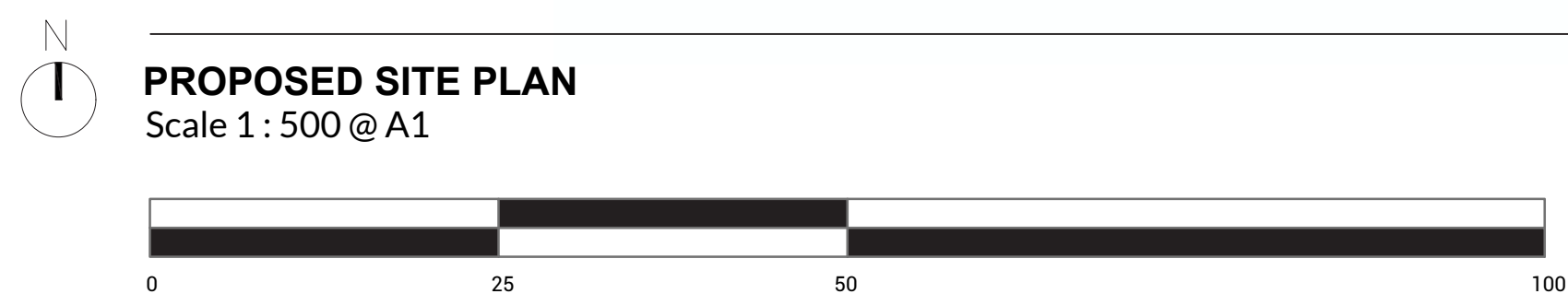
- Chemical and geotechnical analysis of the shallow Made Ground encountered in the west of Site, if it is to be re-use on Site prior to construction; and,
- Foundations Works Risk Assessment.

The following recommendations for the development of the Site are made:

- Waste classification has not been undertaken as part of the scope of works, should it be proposed to dispose of materials from the Site then specific additional investigations may be needed to classify the materials in accordance with current regulatory requirements;
- Unidentified localised areas of contamination may exist at the Site and an appropriate 'hotspot' protocol should be in place for groundworkers to act upon should such contamination be identified during the construction process;
- Suitable dust suppression techniques and prevention of nuisance/environmental impacts will need to be implemented by the groundworkers during construction works; and
- The re-use of materials on-site may be possible if required and where the material is chemically and geotechnically suitable for its proposed end location. Material re-use would need to be undertaken under a Materials Management Plan. Any imported material, including topsoil would also be chemically and geotechnical suitable for its proposed end-use.

Drawings

Drawing 1 - Proposed Development Plan



KEY

THE SITE

Location: Unit A Finlan Rd, Stakehill Industrial Estate

Outline of existing service yard & existing car park

Loading Doors	Existing	Proposed
Euro Dock Leveller	0	1
Dock Leveller	2	3
Level Access Doors	4	6

Parking	Existing	Proposed
Total Staff Parking	108	97
Total EV Charging Bays	0	9
HGV Parking Spaces	0	11

WAREHOUSE -	8,910 sqm	95,906 sqft
OFFICE AREA -	761 sqm	8,191 sqft
TOTAL -	9,671 sqm	104,097 sqft

Notes: Do not scale from this drawing. Use figured dimensions in all cases. Check all dimensions on site. Report any drawing errors or discrepancies to O'Brien & Noel Architects before proceeding. This drawing has been created for the purposes identified in the status and should only be used for this purpose. This is not a construction drawing. To be read in conjunction with all approved documents, permits, drawings and information and drawings from other appointed consultants.

[illegible]

O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19 9WR

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

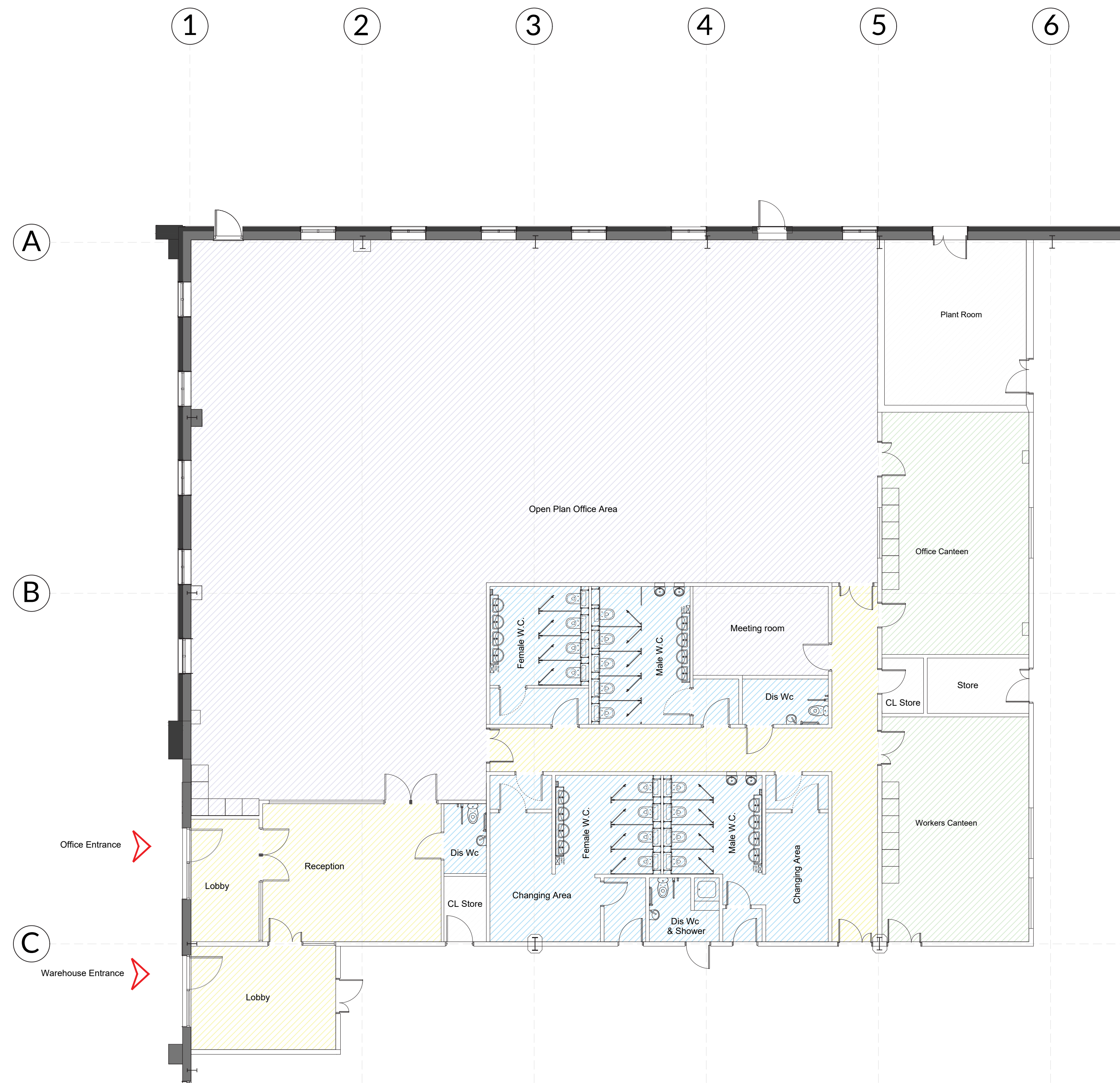
UBS Triton Property Fund

Proposed Site Plan

PURPOSE OF ISSUE

PLANNING

DRAWN BY MO	CHECKED BY PN	DATE APR 2023
SCALE (@ A1) AS SHOWN	PROJECT NUMBER 0127	
DRAWING NUMBER P100		REV D



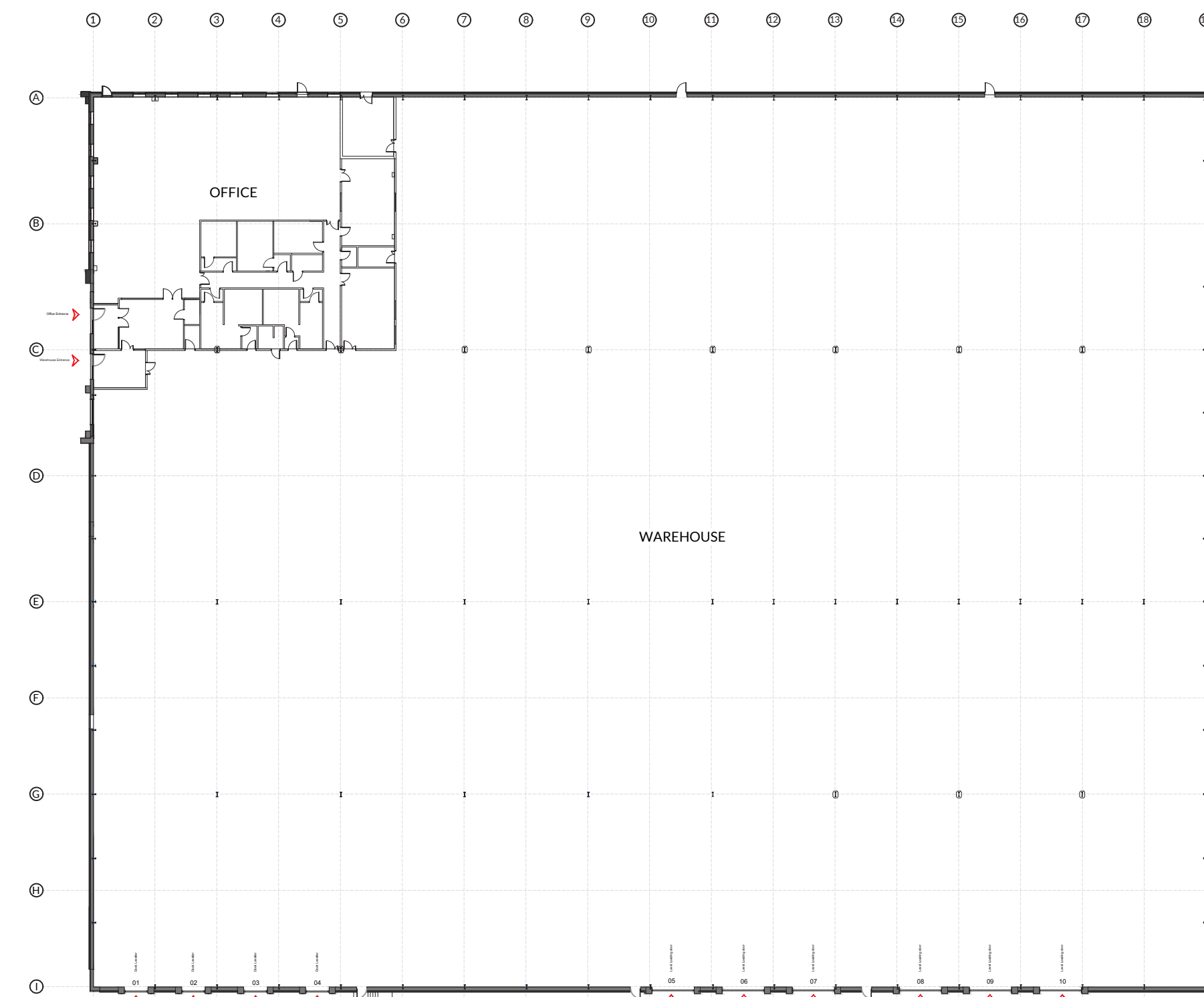
PROPOSED OFFICE LAYOUT
Scale 1:100 @ A1



Scale 1:1250 @ A1



PROPOSED SITE PLAN
Scale 1 : 1250 @ A1



Scale 1:500 @ A1



PROPOSED GROUND FLOORPLAN
Scale 1 : 500 @ A1

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Rev	Description	Date
A		24/02/2023
B	Additional annotations added to drawings	03/04/2023
C	Additional planting added to replace existing car park entrance	18/04/2023

O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

EDUCATION

Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

PROJECT

UNIT A - Partial Demolition, Proposed Extension & Site Landscape Alterations.

CLIENT

UBS Triton Property Fund

DRAWING TITLE

Proposed Floorplans

PURPOSE OF ISSUE

PLANNING

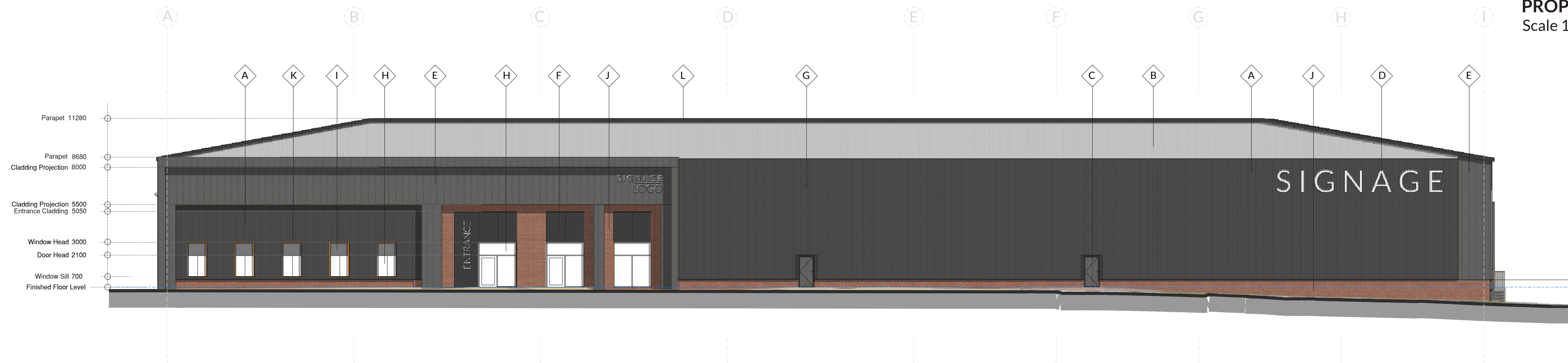
DRAWN BY MO	CHECKED BY PN	DATE APR 2023
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SCALE (@ A1)	PROJECT NUMBER
AS SHOWN	0127

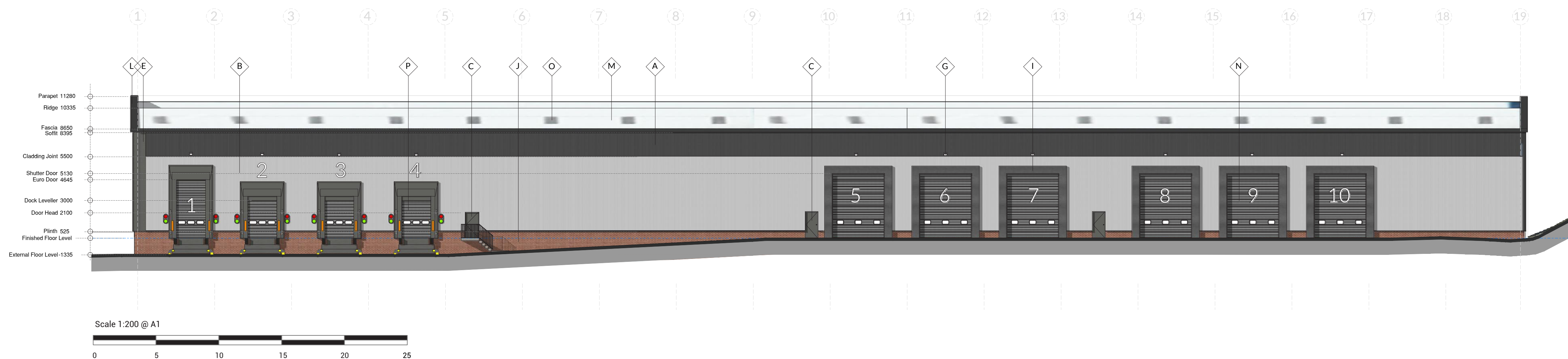
DRAWING NUMBER	REV
P101	C

PROPOSED MATERIALS KEY

- | | | | | | |
|----------|---|----------|--|----------|--|
| A | FACADE - CLADDING 001 (DARK GREY)
Existing profile metal cladding panels to be made good and painted Ral 9017.
Proposed extension to be similarly clad to create a unified facade. | F | FACADE - CLADDING 004 (DARK GREY)
Proposed new insulated composite cladding panels, Ral 9017 | L | PARAPET CAPPING
Existing & proposed capping to be Ral 9017 |
| B | FACADE - CLADDING 002 (LIGHT GREY)
Existing profile metal cladding panels to be made good and painted Ral 7047.
Proposed extension cladding to match to create a unified facade. | G | DOWN LIGHTS
Powder-coated (colour RAL 7016). | M | NEW ROOF (PALE GREY)
Proposed roof system to match existing. Composite or buildup roof system, 12.5% roof lights. |
| C | FIRE ESCAPE DOORS
Existing and proposed fire doors to be steel faced fire escape / personnel doors.
Ral 9007, surrounding revel to be painted a darker shade of grey, Ral 9017. | H | WINDOWS
Thermally broken aluminium window and doors system, Colour: RAL 9005 | N | PROPOSED SHUTTER DOORS (MID GREY)
New insulated composite panel level access door, Ral 9007.
With 3 vision panels. |
| D | SIGNAGE
Proposed tenant signage zone.
Signage consent form to be submitted by future tenant.
Dimension of indicative sign shown 1500mm(W) X 10000mm (H). | I | FACADE - CLADDING 005 (MID GREY)
Proposed new insulated composite cladding panels, Ral 9007. | O | PROPOSED ROOF LIGHTS
Kingspan Trapezoidal roof lights. |
| E | FACADE - CLADDING 003 (MID GREY)
Proposed new insulated composite cladding panels laid vertically, Ral 9007. | J | FACADE - RED BRICK
New red facing brickwork to match existing brickwork plinth. | P | PROPOSED DOCK LEVELLER DOORS (MID GREY)
New insulated composite panel dock leveller door, Ral 9007.
With 3 vision panels. |
| | | K | OFFICE WINDOW REVEALS
Proposed office window reveals to be clad in orange, Ral 2011. | | |



PROPOSED FRONT ENTRANCE ELEVATION - A
Scale 1 : 200 @ A1



PROPOSED SIDE ELEVATION - B
Scale 1 : 200 @ A1



PROPOSED SITE PLAN / ROOF PLAN
Scale 1:1250 @ A1



THE SITE
 Location: Unit A Finlan Rd, Stakehill
 Industrial Estate
 26,970M² (SQ Meters) - 2.7 Hectares

 AREA OF PROPOSED EXTENSION

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O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

PROJECT
UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

CLIENT
UBS Triton Property Fund

DRAWING TITLE

Proposed Elevations

PURPOSE OF ISSUE

PLANNING

DRAWN BY MO	CHECKED BY PN	DATE APR 2023
SCALE (@ A1) AS SHOWN	PROJECT NUMBER 0127	
DRAWING NUMBER L102		REV C

PROPOSED MATERIALS KEY

- | | | | |
|----------|--|----------|---|
| A | <p>FACADE - CLADDING 001 (DARK GREY)
 Existing profile metal cladding panels to be made good and painted Ral 9017.
 Proposed extension to be similarly clad to create a unified facade.</p> | F | <p>FACADE - CLADDING 004 (DARK GREY)
 Proposed new insulated composite cladding panels, Ral 9017</p> |
| B | <p>FACADE - CLADDING 002 (LIGHT GREY)
 Existing profile metal cladding panels to be made good and painted Ral 7047.
 Proposed extension cladding to match to create a unified facade.</p> | G | <p>DOWN LIGHTS
 Powder-coated (colour RAL 7016).</p> |
| C | <p>FIRE ESCAPE DOORS
 Existing and proposed fire doors to be steel faced fire escape / personnel doors.
 Ral 9007 ,surrounding revel to be painted a darker shade of grey, Ral 9017.</p> | H | <p>WINDOWS
 Thermally broken aluminium window and doors system, Colour: RAL 9005</p> |
| D | <p>SIGNAGE
 Proposed tenant signage zone.
 Signage consent form to be submitted by future tenant.
 Dimension of indicative sign shown 1500mm(W) X 1000mm (H).</p> | I | <p>FACADE - CLADDING 005 (MID GREY)
 Proposed new insulated composite cladding panels, Ral 9007.</p> |
| E | <p>FACADE - CLADDING 003 (MID GREY)
 Proposed new insulated composite cladding panels laid vertically, Ral 9007.</p> | J | <p>FACADE - RED BRICK
 New red facing brickwork to match existing brickwork plinth.</p> |
| | | K | <p>OFFICE WINDOW REVEALS
 Proposed office window reveals to be clad in orange, Ral 2011.</p> |



THE SITE
 Location: Unit A Finlan Rd, Stakehill Industrial Estate
 26,970M² (SQ Meters) - 2.7 Hectares

 AREA OF PROPOSED EXTENSION

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O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

PROJECT
UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

CLIENT
UBS Triton Property Fund

DRAWING TITLE

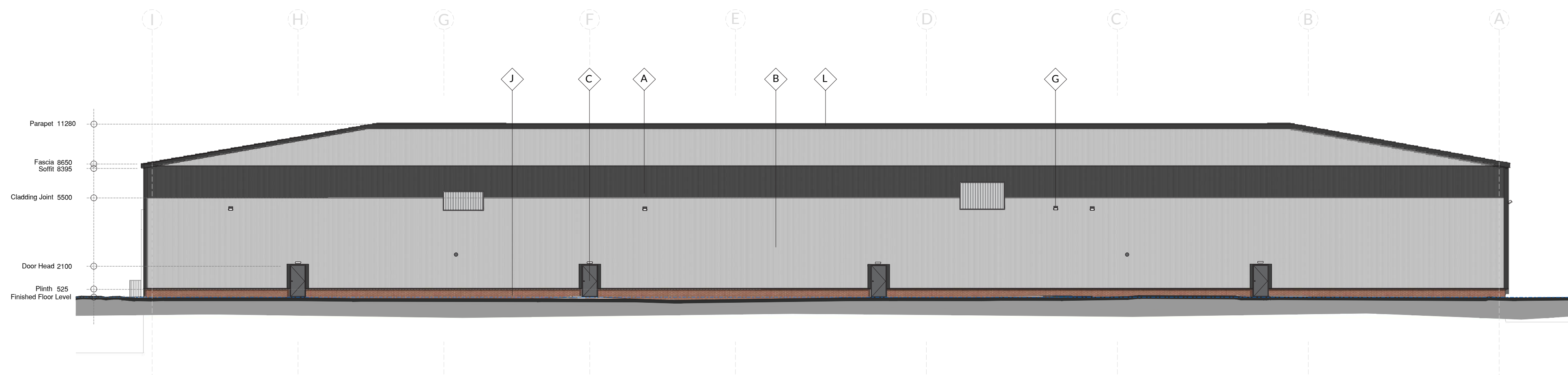
Proposed Elevations

PURPOSE OF ISSUE

PLANNING

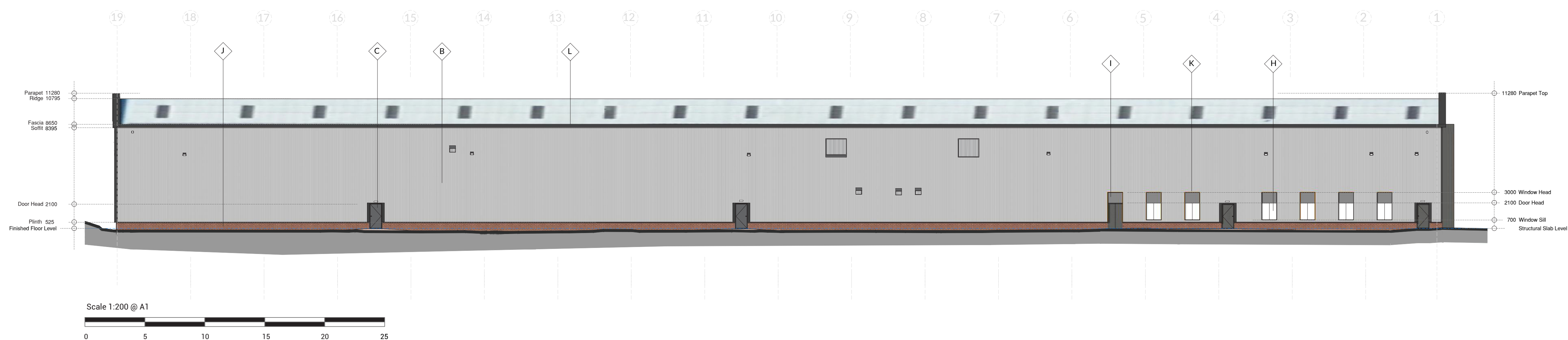
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SCALE (@ A1) AS SHOWN	PROJECT NUMBER 0127	
DRAWING NUMBER P103	REV C	

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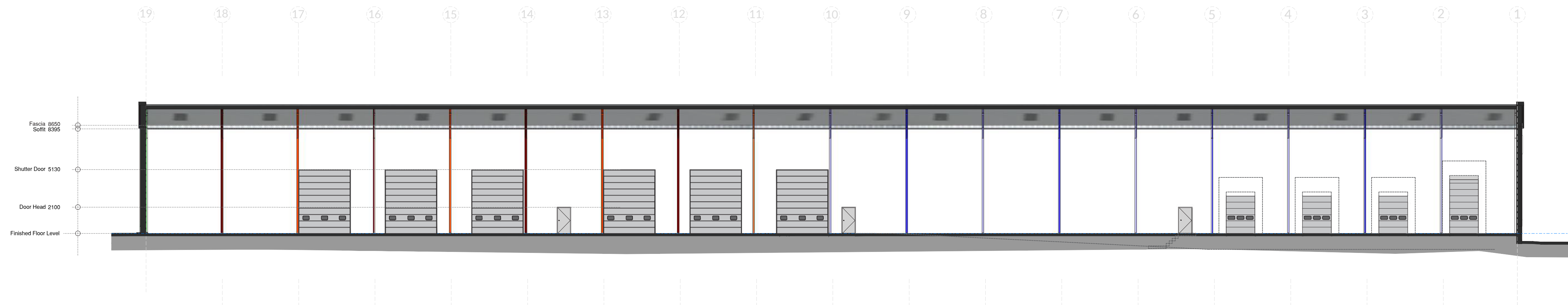
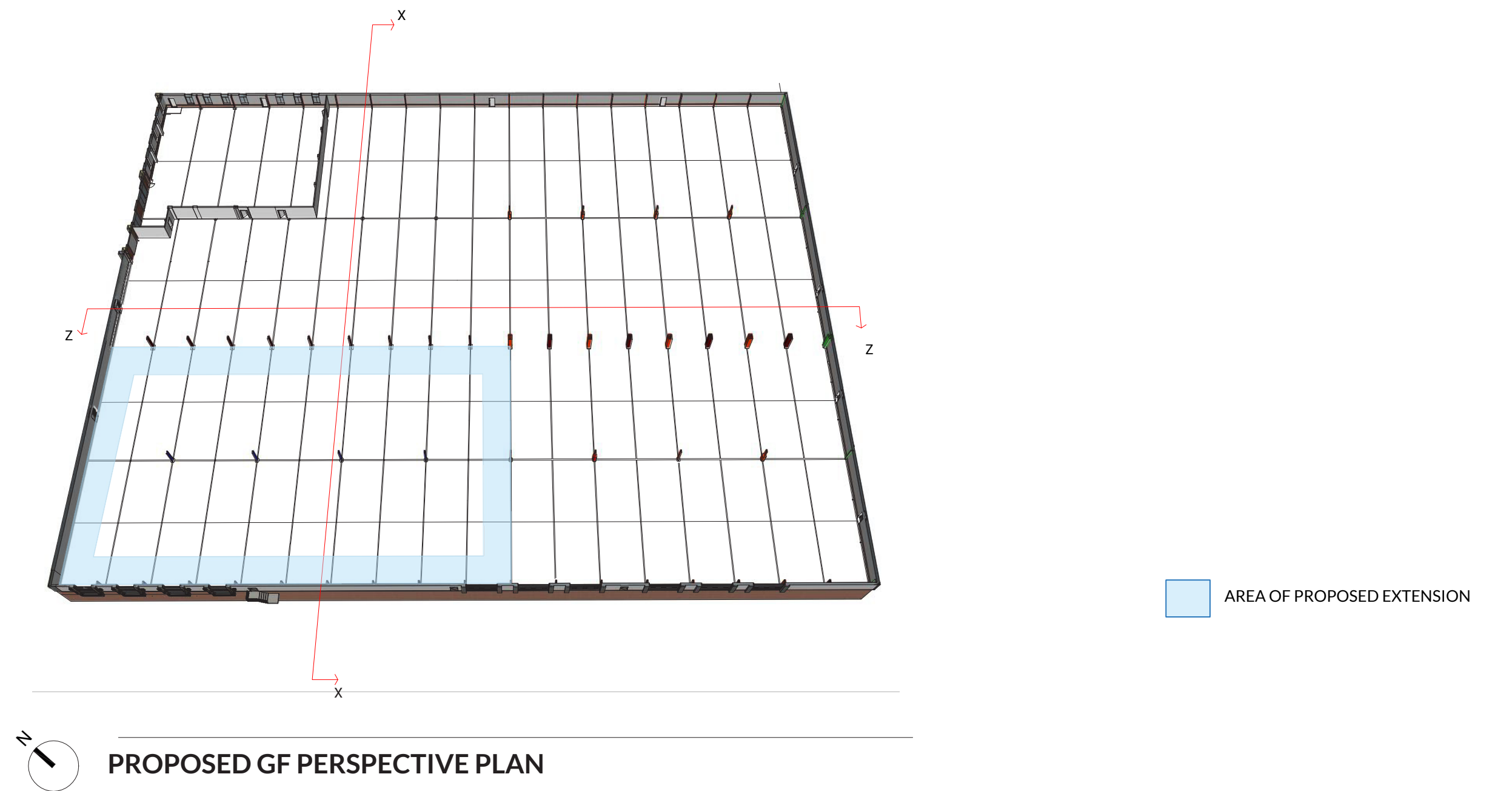
PROPOSED REAR ELEVATION - C

Scale 1 : 200 @ A1

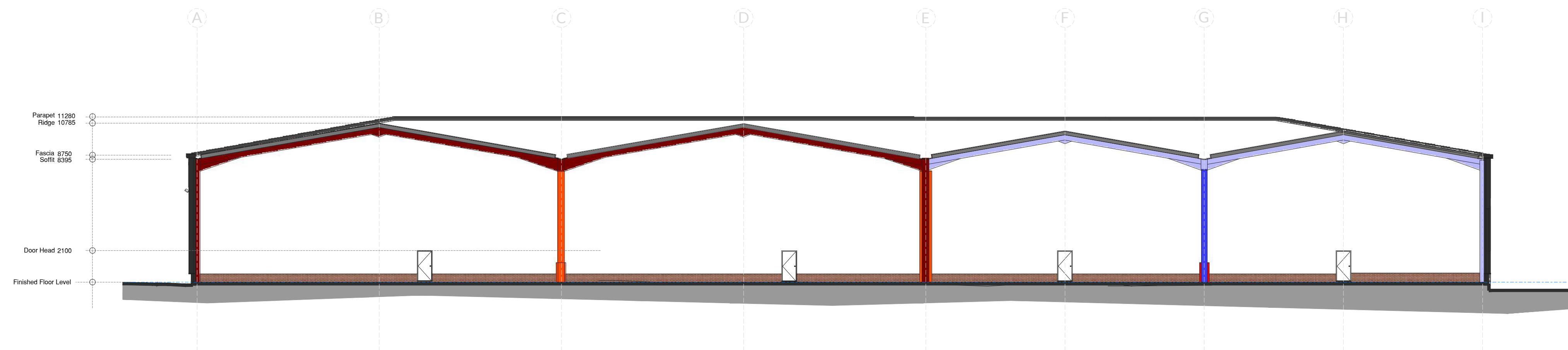


PROPOSED REAR SIDE ELEVATION - D

Scale 1 : 200 @ A1



PROPOSED SECTION - ZZ
Scale 1 : 200 @ A1



Scale 1:200 @ A1

0 5 10 15 20 25

PROPOSED SECTION - XX
Scale 1 : 200 @ A1

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O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19 9WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

UBS Triton Property Fund

RAWING TITLE

Proposed Sections

PURPOSE OF ISSUE

PLANNING

DRAWN BY MO		CHECKED BY PN	DATE APR 2023
SCALE (@ A1) AS SHOWN		PROJECT NUMBER 0127	
DRAWING NUMBER P104			REV C

AREAS OF ADDITIONAL SOFT LANDSCAPING

- 01

479 sqm

Native Wild Planting Area
Species-rich grass planting and scattered trees with some sections of native hedge
- 02

100 sqm

Native Wild Planting Area
Species-rich grass planting and scattered trees with some sections of native hedge
- 03

104 sqm

Grass Picnic Area
Grass to be seeded with hard wearing grass mix
- 04

226 sqm

Native Wild Planting Area with perimeter ornamental hedge
Species-rich grass planting and scattered trees with some sections of native hedge
- 05

76 sqm

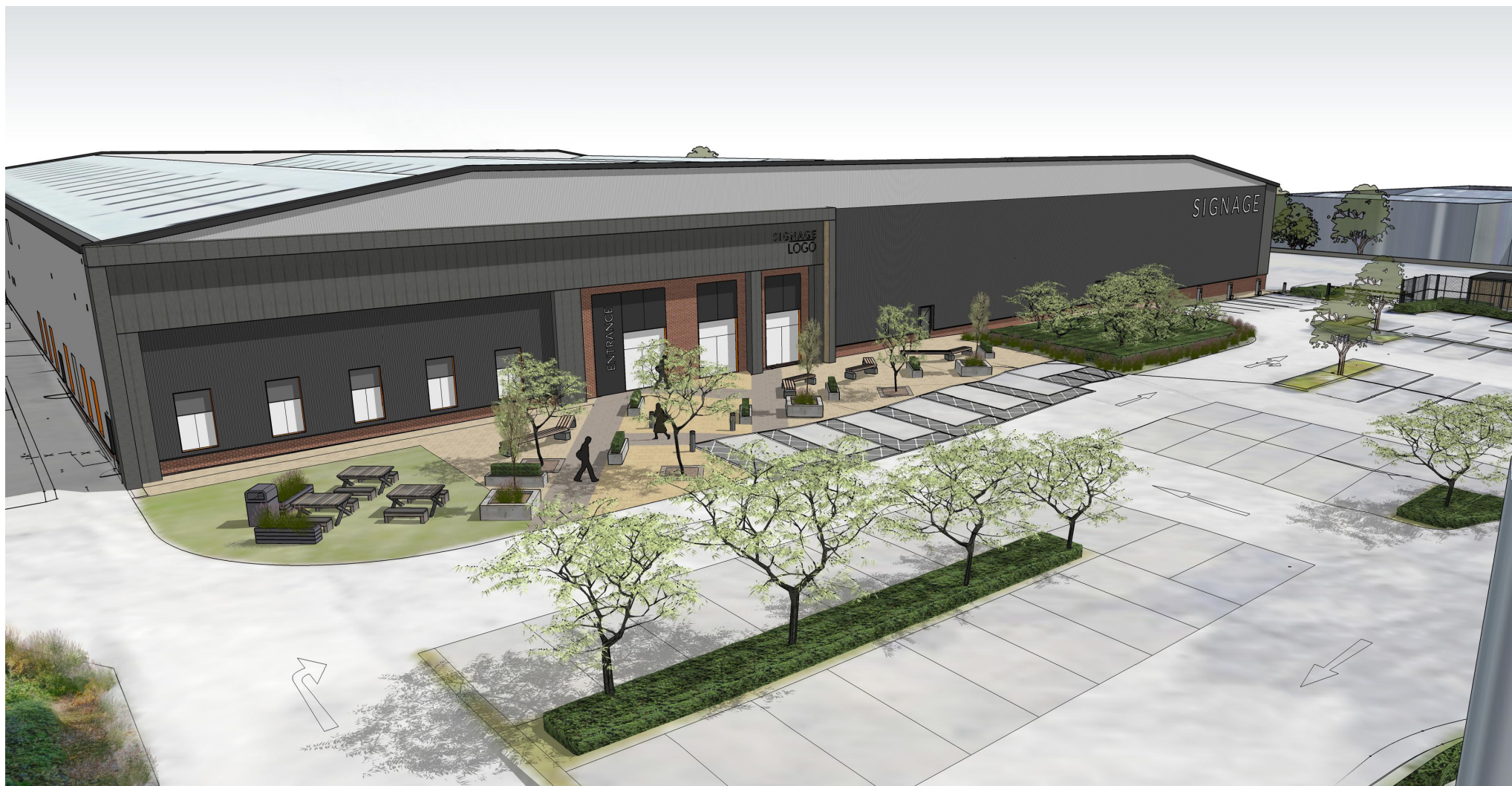
Native Wild Planting Area
Species-rich grass planting and scattered trees with some sections of native hedge
- 06

25 sqm

Native Wild Planting Area
Species-rich grass planting and scattered trees with some sections of native hedge

TOTAL 1010 sqm

Total 97 parking spaces



PERSPECTIVE VIEW SHOWING PROPOSED ENTRANCE AND ASSOCIATED LANDSCAPING

LEGEND

- HARD LANDSCAPE

Proposed Tarmac Surfacing
- Solid Concrete Hard Standing
- Proposed Concrete Block Paving
Material: Marhalls Saxon, 400x400mm
Colour: Natural , Buff and Charcoal to be used
Laying Bond: Running Bond
- SOFT LANDSCAPE

Existing Tree and Hedges to be Retained
Trees and hedges to be retained and protected in line with BS5837:2012.
- Proposed Native Wild Planting Area
- Proposed Native Avenue Trees
Advanced Nursery Stock, 18-20cm girth, with 2m clear stem. To be planted with a double timber stakes secured with a rubber tree tie.
- Proposed Native Trees in resin bond treepit
Extra Heavy Standard, 14-16cm girth, 4.5-6.25m high to be planted with a double timber stake secured with a rubber tree tie.
- Smaller Proposed Native Trees
Set in a raised planters, planted with ornamental shrubs and grasses
- Ornamental Shrub Planting
Proposed shrubs and flowering herbaceous plants to be planted as 5-10L pots at 3-5 per sq.m., 10-12L pots.
- Proposed Grass
Grass to be seeded with hard wearing grass mix
- Existing Ornamental Hedges to be retained
To be maintained at 100cm high.
- Proposed Native Semi-Evergreen Woodland Mix
Proposed native woodland mix to be bare root stock, 40-60cm high, planted at 1.5 plants per sq.m.
- Proposed Native Semi-Evergreen Shrub Mix
Proposed native shrub mix to have minimum 3 species. To be bare root stock, 40-60cm high, planted at 2 plants per sq.m.
- Existing Trees to be Retained
- Existing Trees and Hedges to be Removed
- BOUNDARIES
Existing Fencing to be retained
- Proposed dividing fencing with heavy duty raise barrier arm.
- Armco barrier to protect the proposed retaining wall
- Proposed Benches and sub planters located in front of building entrance
- Proposed Bollards

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Rev	Description	Date
A		24/02/2023
B	Additional annotations added to drawings	03/04/2023
C	Additional planting added to replace existing car park entrance	18/04/2023
D	Legend updated	19/04/2023
E	Tree annotation updated	20/04/2023

O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

PROJECT
UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

CLIENT
UBS Triton Property Fund

DRAWING TITLE
Proposed Landscape Plan

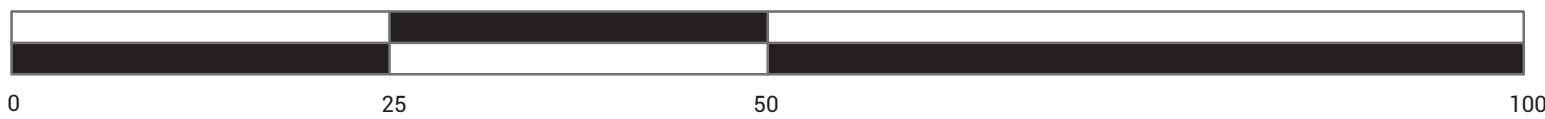
PURPOSE OF ISSUE
PLANNING

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DRAWING NUMBER P105		REV E

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PROPOSED LANDSCAPE PLAN
Scale 1 : 500 @ A1





PERSPECTIVE IMAGE - A_ VIEW OF THE PROPOSED ENTRANCE



PROPOSED SITE PLAN / ROOF PLAN
Scale 1 : 1250 @ A1



THE SITE
Location: Unit A Finlan Rd, Stakehill
Industrial Estate
26,970M² (SQ Meters) - 2.7 Hectares

AREA OF PROPOSED EXTENSION



PROPOSED PERSPECTIVE VIEWS
AERIAL IMAGE - B_ VIEW OF THE PROPOSED SERVICE YARD & PROPOSED ENTRANCE CAR PARK

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ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION
Unit A
Finlan Road
Stakehill-Industrial-Estate
Middleton
M24 2SJ

PROJECT
UNIT A - Partial Demolition, Proposed Extension
& Site Landscape Alterations.

CLIENT
UBS Triton Property Fund

DRAWING TITLE
Proposed 3D Views

PURPOSE OF ISSUE
PLANNING

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SCALE (@ A1) AS SHOWN	PROJECT NUMBER 0127	
DRAWING NUMBER P106		REV C



PERSPECTIVE IMAGE - C_VIEW OF THE PROPOSED SERVICE YARD



PROPOSED SITE PLAN / ROOF PLAN
Scale 1 : 1250 @ A1



THE SITE
 Location: Unit A Finlan Rd, Stakehill
 Industrial Estate
 26,970M² (SQ Meters) - 2.7 Hectares

AREA OF PROPOSED EXTENSION

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O'BRIEN & NOËL
ARCHITECTS

PO BOX 810
STANDISH, WIGAN
WN19WR

0125 741 5402
0151 528 2211
contact@obriennoel.com
www.obriennoel.com

LOCATION

Finlan Road
Stakehill-Industrial-Estate
M24 2RW

PROJECT

Proposed Extension UNIT A

CLIENT

SAVILLS

DRAWING TITLE

Proposed 3D Views

PURPOSE OF ISSUE	
------------------	--

PLANNING

DRAWN BY MO	CHECKED BY PN	DATE APR 2023
SCALE (@ A1) AS SHOWN	PROJECT NUMBER 0127	
DRAWING NUMBER P107	REV C	

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PROPOSED PERSPECTIVE VIEWS

PROPOSED PERSPECTIVE VIEWS
AERIAL IMAGE - D_VIEW OF THE PROPOSED SERVICE YARD